

WHAT IS CLAIMED IS:

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1. An apparatus comprising:
one or more optical fibers or other waveguides for receiving light; and
a plurality of tap structures formed in the one or more optical fibers or waveguides configured so that, when the light travels through said one or more optical fibers or waveguides, a predetermined pattern is created by scattering, reflection and/or refraction of portions of the light through the one or more tap structures.
 2. The apparatus according to claim 1, wherein the predetermined illumination pattern is generally spherical in shape.
 3. The apparatus according to claim 1, wherein the predetermined illumination pattern is generally in the shape of an arc.
 4. The apparatus according to claim 1, wherein the predetermined illumination pattern is generally cylindrical in shape.
 5. The apparatus according to claim 1, wherein the predetermined illumination pattern is generally conical in shape.

6. The apparatus according to claim 1, further comprising:

one or more reflective surfaces disposed within the one or more optical fibers or waveguides, wherein the one or more reflective surfaces reflects the light so that the reflected beam of light travels in a direction substantially opposite to the original direction of travel of the light.

7. The apparatus according to claim 1, wherein the plurality of tap structures have an asymmetrical geometry.

8. The apparatus according to claim 1, wherein the plurality of tap structures extend radially or completely around the one or more optical fibers or waveguides.

9. The apparatus according to claim 1, wherein the plurality of tap structures each comprise a continuous circular tap structure.

10. The apparatus according to claim 1, wherein the plurality of tap structures are arranged in an array extending along a length of the one or more optical fibers or waveguides.

11. The apparatus according to claim 1, wherein the plurality of tap structures each have a length extending in a longitudinal direction of the respective optical fiber or waveguide larger than a width extending in a radial direction of the respective optical fiber or waveguide.

12. The apparatus according to claim 1, further comprising:

one or more light sources that provide the light to the one or more optical fibers or waveguides.

13. The apparatus according to claims 12, wherein the one or more light source comprises a plurality of selectively controllable light sources.

14. The apparatus according to claim 13, wherein the plurality of selectively controllable light sources have varying illumination powers.

15. The apparatus according to claim 12, wherein the one or more light sources provide at least partially coherent light to the one or more optical fibers or waveguides.

16. The apparatus according to claim 12, wherein the one or more light sources provide incoherent light to the one or more optical fibers or waveguides.

17. The apparatus according to claim 12, wherein the one or more light sources provide visible light to the one or more optical fibers or waveguides.

18. The apparatus according to claim 12, wherein the one or more light sources provide UV light to the one or more optical fibers or waveguides.

19. The apparatus according to claim 12, wherein the one or more light sources provide infrared light to the one or more optical fibers or waveguides.

20. The apparatus according to claim 12, wherein the one or more light sources comprise one or more lasers.

21. The apparatus according to claim 20, wherein the one or more light source comprise one or more semiconductor laser diodes.

22. The apparatus according to claim 20, wherein the one or more light sources comprise one or more high power laser diodes.

23. The apparatus according to claim 20, wherein the one or more light sources comprise one or more light emitting diodes.

24. An apparatus comprising:
one or more optical fibers or other waveguides for receiving light; and
a continuous tap structure formed in the one or more optical fibers or waveguides configured so that, when the light travels through said one or more optical fibers or waveguides, a predetermined illumination pattern is created by scattering, reflection and/or refraction of portions of the light through the one or more tap structures.

25. An apparatus comprising:
one or more optical fibers or waveguides for receiving light; and
one or more tap structures formed in the one or more optical fibers or waveguides configured so that, when the light travels through said one or more optical fibers or waveguides, an amount of the light output through the one or more tap structures is optimized.

26. The apparatus according to claim 25, wherein greater than approximately 90% of the light is output through the one or more tap structures.

27. An apparatus comprising:

one or more photon channeling structures for receiving photons; and

a plurality of tap structures formed in the one or more photon channeling structures configured so that, when the photons travel through said photon channeling structures, a predetermined pattern is created by scattering reflection and/or refraction of portions of the photons through the one or more tap structures.

28. The apparatus according to claim 27, wherein the photons comprise light.

29. The apparatus according to claim 27, wherein the photons comprise incoherent radiation.

30. A method of determining illumination patterns resulting from light passing through one or more tap structures on one or more optical fibers or waveguides, comprising:

selecting illumination pattern parameters for the one or more tap structures;

geometrically modeling the cross section of each of the one or more tap structures using the illumination parameters; and

predicting propagation direction and intensity of the plane waves.

31. The method according to claim 30, wherein geometrically modeling comprises geometrically modeling using a planar waveguide.

32. The method according to claim 30, wherein geometrically modeling comprises geometrically modeling using a cylindrical waveguide.

33. The method of claim 30, further comprising:
determining whether the predetermined illumination pattern has been obtained;
adjusting the illumination parameters if the predetermined illumination pattern has not been obtained; and
repeating the steps of claim 30.

34. An optical fiber or waveguide having a plurality of tap structures designed to output a predetermined illumination pattern using the method of claim 30.

35. An optical fiber or waveguide having a plurality of tap structures designed to output a predetermined illumination pattern using the method of claim 33.

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ABSTRACT OF THE DISCLOSURE

5 An apparatus is provided that includes one or more optical fibers or other waveguides for receiving light, and a plurality of tap structures formed in the one or more optical fibers or waveguides configured so that, when the light travels through the one or more optical fibers or waveguides, a predetermined illumination pattern is created by scattering, reflection and/or refraction of portions of the light through the one or more tap structures. The predetermined illumination pattern can be spherical, cylindrical or conical in shape. The illumination pattern can also be in the shape of an arc. The apparatus can be utilized with one or more light sources. Further, a method is provided of determining illumination patterns resulting from light passing through one or more tap structures on one or more optical fibers or waveguides. The method includes selecting illumination pattern parameters for one or more tap structures, geometrically modeling the cross section of each of the one or more tap structures using the illumination patterns, and predicting propagation direction and intensity of the plane waves.